Roll No												

PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING

MAKEUP EXAMINATION – JAN 2023

Date: 24-JAN-2023

Course Code: ECE 314

Time: 01:00 pm to 04:00 pm

Course Name: Linear Algebra for Communication Engineering

Max Marks: 100 Marks

Program : B. Tech

Weightage: 50%

Instructions:

(i) Read all questions carefully and answer accordingly.

(ii) Non-Programmable and Scientific Calculators permitted

Part A [Memory Recall Questions]

Answer all the Questions. Each question carries FIVE marks (6Qx 5M= 30M)

1. Given an n * n matrix A and n * 1 column matrices B and X, solve AX = B for X. Assume that all necessary inverses exist. [C.O.No.1] [Knowledge Level]

2. Solve a System of linear equations by Substitution method : 5x + y = 4 , 2x - 3y = 5 [C.O.No.1] [Knowledge Level]

3. Given the matrices $A = \begin{bmatrix} 0 & 9 \\ 2 & -3 \\ -1 & 1 \end{bmatrix}$ $B = \begin{bmatrix} 8 & 1 \\ -7 & 0 \\ 4 & -1 \end{bmatrix}$ $C = \begin{bmatrix} 2 & 3 \\ -2 & 5 \\ 10 & -6 \end{bmatrix}$ compute 3A+2B-1/2C [C.O.No.1] [Knowledge Level]

4. The Row space of matrix A, is the set of all linear combinations of the rows of matrix A and Rank is the dimension of row A which is given by the number of vectors in the basis of row A. Give the basis of the row space and the rank of the matrix

$$A = \begin{bmatrix} 1 & 0 & -6 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 2 & 0 & -9 \end{bmatrix}$$

[C.O.No.1] [Knowledge Level]

5. Define Inner product and Inner product space. Also list the axioms for the same. [C.O.No.2] [Knowledge Level]

6. Let S be a set that contains vectors $v_1, v_2, \ldots. v_n$. Define Orthogonal vectors, orthogonal set, orthonormal set and basis of a vector space. [C.O.No.2] [Knowledge Level]

Part B [Thought Provoking Questions]

Answer all the Questions. Each question carries TEN marks. (3Qx10M=30M)

7. By using elementary row operations, Determine the inverse of the following matrix given that it is invertible. $A = \begin{bmatrix} 3 & 1 & 0 \\ -1 & 2 & 2 \\ 5 & 0 & -1 \end{bmatrix}$ [C.O.No.1] [Application Level]

8 i) Geometrically, an eigen vector of a matrix A is a non-zero vector x in R^n such that the vector x and Ax are parallel. It can be determined by solving the homogeneous system of equations (A-λI)x=0 for each eigen value λ. Determine the eigen values and eigen vectors of A=$\begin{bmatrix} 2 & 1 \\ 4 & -1 \end{bmatrix}$

ii) Explain the properties of determinant. [C.O.No.2] [Comprehension Level]

9. Solve the following system of equations using cramer's rule.

$x + y + z = 8$, $x - y + 2z = 6$, $3x + 5y - 7z = 14$ [C.O.No.2] [Application Level]

Part C [Problem Solving Questions]

Answer all the Questions. Each question carries TEN marks. (4Qx10M=40M)

10. Diagonalize the following matrix, if possible $A = \begin{bmatrix} 1 & 3 & 3 \\ -3 & -5 & -3 \\ 3 & 3 & 1 \end{bmatrix}$. Find an invertible matrix P and a diagonal matrix D such that $A=PDP^{-1}$

[C.O.No.2] [Application Level]

11. Apply Gram-Schmidt orthogonalization process to the basis B={(1,0,1),(1,0,-1),(0,3,4)} of the inner product space R^3 to find an orthogonal basis of R^3.

[C.O.No.2] [Application Level]

12. Construct the L and U matrix by the method of factorization $A = \begin{bmatrix} 1 & 3 & 0 \\ 2 & 4 & 0 \\ 2 & 0 & 1 \end{bmatrix}$

[C.O.No.2] [Application Level]

13. Find a Singular Value Decomposition of the given matrix $A = \begin{bmatrix} 1 & -1 \\ -2 & 2 \\ 2 & -2 \end{bmatrix}$

[C.O.No.3] [Application Level]